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The Presence of Metabolic Syndrome Components in Obese Female Subjects in General Population

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Abstract

The percentage of overweight/ obese adult female in Indonesia in 2008 was 25% and 6.9%, consecutively. Metabolic syndrome associates with increase in all-cause mortality, increase risk of some cancers in adult and postmenopausal female, diabetes melitus and cardiovascular disease in elderly. NCD deaths account for 34% of overall annual deaths in SEAR countries, and more than 55% in Indonesia. Little known about MetS and the existence of its components among obese adult females in general population. This study aims to evaluate metabolic syndrome components in obese female subjects from general population. This cross sectional study conducted in Medan-North Sumatra. The subjects had no history of hypertension, hyperlipidemia, and diabetes melitus, nor taking medication for treatment. Subjects recruited consecutively with purposive sampling. Body height, body weight, blood pressure, laboratory examination for high-density lipoprotein cholesterol levels, triglyceride levels, and fasting plasma glucose levels were measured. Subjects are 24 obese female adults, age between 30-61 year, waist circumference 92.0-43.0 cm, and body mass index ranges from 30.18-56.20 kg /m2. Study found that 18 (75.0%) subjects were with metabolic syndrome (MetS), and 6 (25.0%) subjects were not metabolic syndrome (NMetS). In MetS subjects, the component found were low HDLc levels (in 70.8%), raised TG levels (58.3%), raised FPG levels (41.7%), and increased BP (33.3%). In NMets subjects, components found were increased BP (found in 12.5%), and low HDLc levels (in 8.3%). In this study, obese female subjects experienced MetS and NMetS, the components found were decreased HDLc levels, increase in TG levels, FPG levels, and BP.

Keywords: metabolic syndrome; obesity; female.

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1. Introduction

Overweight and obesity as behavioural risk factors of noncommunicable diseases (NCDs) was more prevalent higher among females than in males in South-East Asia Region (SEAR) countries, except in Nepal [1]. The prevalence of overweight varied from 8% to 52% among females [1]. In Indonesia, in the year of 2008, percentage of female adult population that was overweight and obese were 25% and 6.9% consecutively [2]. The prevalence of overweight, obese and extremely obese female adult were 26,5 %, 40.4%, and 9.9%, respectively in 2013-2014 [3].

Raised BMI is among the leading risk factors for NCDs, it accentuates early development of DM and CVDs by triggering metabolic dysfunctions, raising BP, blood glucose and cholesterol levels [1]. Overweight and obesity are the fifth leading risk for global deaths [1]. Cardiovascular diseases (CVD), cancer, chronic respiratory diseases and diabetes are four major NCDs responsible for 82% NCD deaths. Noncommunicable disease account for 55% of the estimated 14.5 million total deaths in 2008 in SEAR countries, and NCD deaths are expected to increase by 21% over the next decade [2]. Noncommunicable diseases are projected to increase from 38 million in 2012 to 52 million by 2030 [4].

Researches had revealed negative impacts of metabolic syndome (MetS). Women holding only some risk factors for MetS were at increased risk of type 2 diabetes melitus (T2DM) or cardiovascular diseases (CVDs) compared to women with no MetS risk Factors [5]. Puberty, pregnancy and menopause are related to alterations in energy homeostasis and gonadal steroids levels followed by increase of body fat and insulin resistance, important components of MetS [6], and metabolic disorders like hyperlipidemia, obesity, and diabetes can affect the reproductive health and fertility of female through the interruption of either the ovarian functions or the pituitary-hypothalamic functions [7]. Postmenopausal status is associated with an increased of the MetS independent of normal aging [8]. Metabolic syndrome associated with an increased risk of breast postmenopausal cancer [9], [10], endometrial , pancreas, rectal, and colorectal cancers [10]. Positive association was observed between MetS and breast cancer risk [11]. The syndrome associated with a 2-fold increase in CV outcomes and a 1.5 increase in all-cause mortality [12]. Multiple metabolic disorders is associated with a high risk of severe fibrosis [13], the presence 4 or 5 features of the syndrome increase a 3.7-fold increase in risk for CHD and a 24.5-fold increase for diabetes compared to those of NMetS [14]. Stronger associations were also found in Asia populations for liver cancer, and in European populations for colorectal cancer in women [10].

Metabolic syndrome predicts perioperative and postoperative complications in urologic surgery [15]. Intraoperative hypotension and hypertension were significantly differ between subjects with MetS and NMetS. Postoperative pain complications was significant higher in MetS [16]. The MetS together with BMI >40 was associated with significantly higher risk of Centers for Medicare and Medicaid Services (CMS) reportable complications, wound complications, and readmission compared to MetS with the lower BMI. The risk attributable to MetS increases as BMI increases [17]. The MetS was an independent indicator of the presence of nephropathy and neuropathy in type 1 diabetes and CVD and retinopathy in type 2 diabetes. [18]. This syndrome also explain at least in part the emergence of CVD as the major morbidity and mortality conditions in the HIV population [19].

The term “metabolic syndrome” is used to describe the risk factor cluster of large waistline, high BP, raised blood sugar level, low HDLc levels and high TG levels. When occurring together, MetS form a risky combination for the development of NCDs [1] . Though the component of MetS are behavioural risk factors of NCDs, little information known about MetS and the existence of its components among obese females subjects in general population in Indonesia. This study aims to evaluate MetS components in obese female adult in general population

2. Materials and Methods

Inclusion criteria applied in this study comprised of adult female with central obesity, recruited from general population. Waist circumference (WC) 80 cm or greater is an ethnic specific values used to mark central obesity in female. If body mass index (BMI) is > 30 kg/m2, central obesity can be assumed and WC does not to be measured [20].

Exclusion criteria was history or current use of medication regiments to lower bood pressure (BP), blood glucose, lipid profile, and treatment for cancer. Obese adult females with history of hypertension, dyslipidemia, diabetes mellitus (DM), CVD and or cancer also excluded. Body weight was measured using electronic scales without shoes in light clothing, and height was measured with stadiometer. BMI was calculated as the following: (weight (kilograms)/ height (meter^2)).

Waist circumference was taken twice to the nearest milimeter midway between the iliac crest and lower rib using a measuring tape, an average from the two measurements was used. Three times measurements of systolic and diastolic BP with a Riester sphygmomanometer conducted in the sitting position with 5-min interval between each reading.

The initial reading was discarded and an average of the second and third BP recordings was used for the present analyses. Blood samples were analyzed for high-density lipoprotein cholesterol (HDLc) and triglyceride (TG) levels. The levels of fasting blood glucose (FBG) measured after fasting 8-10 hours overnight, the preparation and procedure were similar to that described elsewhere [21,22].

Subjects defined as MetS according to IDF criteria must present central obesity and at least two of the following four criteria; 1) raised TG levels (≥ 150 mg/dL/ 1.7 mmol/L) or specific treatment for this lipid abnormality; 2) reduced HDL cholesterol (<50 mg/dL/ 1.29 mmol/L) in females; 3) raised BP (systolic BP ≥ 130 or diastolic BP ≥85 mmHg or treatment of previously diagnosed hypertension); 4) raised FPG (FPG ≥ 100 mg/dL (5.6 mmol/L)).

Waist circumference criteria for central obesity is ethnicity specific value [20,23]. The study was approved by Ethical Committee of Faculty of Medicine.

For statistical analysis, data that was not distributed normally are presented as median (min-max). Normally distributed data are given as mean ± SD, and the minimum or maximum levels are given separately in text. Unpaired t-test or Mann-Whitney U test was employed in data analyses.

3. Results

Table 1: Baseline characteristics of the study subjects

N	24
MetS	18 (75%)
NMetS	6 (25%)
Age (years)	44.82 ± 9.05 (30-61)
MetS Age (years)	46.42 ± 8.33
NMetS age (years)	39.7 (30 - 51)
WC (cm)	108.0 (92.0 - 143.0)
BMI (kg/m)	34.98 (30.18 - 56.20)
Systolic BP (mmHg)	122.50 (110 -170)
Diastolic BP (mmHg)	80.00 (70 -120)
FBG (mg/dL)	97.00 (71-289)
HDLc (mg/dL)	44.42 ± 9.34
TG (mg/dL)	150.17 ± 66.29

Abbreviation: WC, waist circumference; BMI, body mass index; systolic BP, systolic blood pressure; diastolic BP, diastolic blood pressure; FBG, fasting blood glucose; HDLc, high density lipoprotein cholesterol; TG, triglyceride. Data are expressed as the means ± SD, or median (min - max).

The study was carried out in 24 obese female adults in general population. Tabel 1 described baseline characteristics of subjects. Seventy-five percent of the subject were defined as MetS, and 25% were NMetS. The overall mean age 44.82 ± 9.05 years. The WC and BMI are 108.0 (92.0 - 143.0) cm and 34.98 (30.18 - 56.20) kg/m^2, respectively. Systolic and diastolic BP measures are 122.50 (110 -170) mmHg and 80.00 (70 -120) mmHg, respectively. The mean FBG is 97.00 (71-289) mg/dL with 289 mg/dL as the highest levels. The mean of HDLc levels and TG levels are 44.42 ± 9.34 mg /dL and 150.17 ± 66.29 mg/ dL consecutively. It is shown in Table 1 that the highest level of TG is 373 mg/ dl and the lowest level of HDLc is 31 mg/ dl.

Table 2: Comparison of the components between subjects with Mets and NMetS

	MetS (n=18)	NMetS (n=6)	*P*
WC (cm)	110.278 ± 11.6154	102.667 ± 6.2183	0.143
Age (year)	47.35 (34.00-61.00)	39.7 (30.00-51.00)	0.17
BMI (kg/ m^2)	35.68 (30.57 -56.20)	31.43 (30.18-37.49)	0.56
Systolic BP (mmHg)	122.50 (110-170)	125 (110-170)	0.72
Diastolic BP (mmHg)	80.00 (70-120)	82.50 (80-110)	0.41
FBG (mg/dL)	110.39 ± 46.971	87.00 ± 6.229	0.243
HDLc (mg/dL)	41.28 ± 6.960	53.83 ± 9.745	0.002
TG (mg/dL)	169.00 (74-373)	89.00 (42-129)	0.001

Table 2 shows HDLc levels were significantly different between subjects with MetS and with NMetS (41.28 ± 6.960 vs 53.83 ± 9.745, *P* 0.002), significantly higher TG levels in subjects with MetS compared with the NMetS (169.00 (74-373) vs 89.00 (42-129), *P* 0.001). Analysis of mean rank demonstrated that TG levels is higher in MetS than in NMets. Subjects experiencing MetS did not differ significantly with those NMetS in terms of WC (*P* 0.143), body mass index (*P* 0.56), blood pressure (SBP *P* 0.72, DBP *P* 0.41), and fasting blood glucose (*P* 0.243). The distribution of age is the same across categories of the metabolic status, hence age differences are not significant between MetS and NMets, although older subjects were found within the MetS group.

Table 3: Distribution of MetS components according to IDF Criteria of Metabolic Syndrome [20] in subjects with different MetS status.

An example of a column heading	MetS	NMetS	Total
	n(%)	n(%)	n(%)
Raised BP (SBP ≥ 130 or DBP ≥85 mmHg)	8 (33.3%)	3 (12.5%)	11 (45.8%)
Raised FBG levels (≥ 100 mg/dL)	11 (45.8%)	-	11 (45.8%)
Reduced HDLc levels (<50 mg/dL)	17 (70.8%)	2 (8.3%)	19 (79.2)
Raised TG levels (≥150 mg/dL)	15 (62.5%)	-	14 (62.5%)

In Table 3, of all subjects, the most frequent component found is reduced HDLc levels (79.2%), followed with raised TG levels (62.5%), raised FBG levels (45.8%) and raised BP (45.8%). In NMets, components found is raised BP and reduced HDLc levels.

Subjects in this study had no history of the disease and were never treated for the diseases listed in the exclusion criteria. Subjects were identified as having MetS and NMetS. More subjects experienced MetS than NMetS. It is well known that obesity has negative impact on female's health. Metabolic syndrome is the a cluster risk factors that form a risky combination for the development of NCDs [1]. Study stated that elderly who were overweight based on BMI had almost a four-fold increased risk for MetS (adjusted odds ratio = 3.98; 95% CI 2.23 - 7.10), and those who had plasma total cholesterol ≥ 240 mg/dl had a 2.7 times greater risk of having MetS than those with plasma total cholesterol < 240 mg/dl [24]. Previous statements in accordance with the findings in this study, that older subjects of this study were found among subjects with MetS.

Health and Demographic Surveillance System (HDSS) conducted in 2005 revealed a considerable proportion of the study populations had high BP, including those in India, Indonesia and Thailand [1]. Males have a slightly higher prevalence of raised BP than females in almost all SEAR countries [1], but females had a higher prevalence of raised cholesterol than males in five of six SEAR Member countries [1]. In the Study of Women's Health Across the Nation (SWAN) females who had < 3 abnormalities were defined as "benign" and those with ≥ 3 abnormalities were define as being "at-risk. Contrary with previous study, the SWAN demonstrated that even metabolically benign overweight /obese (MBO) subjects have a significantly greater subclinical CVD burden than normal weight subjects, despite published data finding similar CVD event rates between the two groups. Prospective studies tracking the progression of subclinical atherosclerosis to clinical CVD in these

subjects are needed [25]. In this study, subjects who recruited from general population have no history of illnesses or taking medication, but they should be aware due to components of MetS that is evidently found among them. It turns out that even NMetS subjects of this study experienced increased BP and low HDL levels. Along with statement that undiagnosed diabetes is a significant problem in the Region [1], raised FBG levels were also found in 11 of 24 subjects with MetS, who never knew that their FBG had increased.

Increasing obesity and the presence of cardiometabolic abnormalities increase the risk of progression, whereas at-risk overweight/obese (ARO) phenotype, a state that is unanimously associated with an elevated risk of cardiovascular morbidity and mortality [26]. Nearly, a third of obese individuals termed metabolically benign obese (MBO), have a low burden of adiposity-related cardiometabolic abnormalities, whereas a substantial proportion of normal-weight individuals posses risk factors. Metabolically benign overweight/obese (MBO) females had an intermediate adipokine profile [between at-risk obese (ARO) and metabolically benign normal-weight] [27]. Six subjects of this study presented with NMetS. Subjects with NMetS have central obesity and less than two risk factors, while metabolically healthy defined as having 0 - 1 metabolic abnormality or unhealthy (≥ 2 metabolic abnormalities) [28]. Study found that metabolically healthy obese (MHO) subjects were not at increased risk of CV disease and all-cause mortality over 7 yr [28], but subjects with NMetS should be aware with overweight/obesity which are modifiable risk factor of CVD [29].

According to criteria used in this study, a raise in BP is expressed if SBP is more than 130 mmHg or more, or DBP is more than 85 mmHg or more, new guidelines categorized hypertension started with SBP 130 mmHg or DBP 80 mmHg [29]. If new guidelines [29] applied in this study, subjects diagnosed with hypertension would be more than 11 (45.8%) both in MetS and NMets group. Therefore, based on previous studies, although the subjects of this study had no medical complaints, had never been diagnosed with NCDs nor taking treatment for NCDs, obese female should be aware of the threat of health problems caused by metabolic syndrome.

Noncommunicable diseases are largely preventable through interventions and policies that reduce the major risk factors. The emergence of NCDs in the Region calls for a paradigm shift to a more comprehensive approach, to a public health approach and to collectively addressing a cluster of diseases in an integrated manner [1]. Some of voluntary global targets to be attained by 2025 consist of reduction in overall mortality from NCD, relative reduction in the prevalence of raised BP, halt the rise in diabetes and obesity, eligible people receive drug therapy and counselling required to treat major NCDs in both public and private facilities targets [4]. Indonesian nation consists of diversed ethnic group. The limitation of this study is have not yet engaged large members of society from various ethnicity. Diversed socio-cultural aspect has the opportunity to be studied, whether it affects the presence of particular or all components of metabolic syndrome.

4. Conclusions

Obese female should be aware of the threat of MetS related health problems. This study concluded that obese female subjects experienced MetS and NMetS, the components found were decreased HDLc levels, increase in TG levels, FPG levels, and BP.

5. Recommendations

Study to be continue with more ubjects from community, to provide data necessary for public policy makers in planning the prevention of NCDs, and provide assitance in the public health and holistic approaches.

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